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Descriptors-*BIOLOGY INSTRUCTION, EXPERIMENTAL PROGRAMS, EXPERIMENTAL TEACHING, *INNOVATION, INSTRUCTION, *INSTRUCTIONAL INNOVATION, *JUNIOR COLLEGES, *SCIENCE EDUCATION, SCIENCE TEACHERS, TEACHING TECHNIQUES

Although every student has a right to expect well informed teachers, many college biology instructors cannot keep up with the new findings in their own and related fields. This model program shows a technique demanding continuing faculty education and greater participation by the student in the educative process. Being comprehensive, the model also emphasizes intellectual and professional development of the biology major through a sequence of courses leading to completely independent work. Although it is designed for small colleges, the model may be adapted to larger and more complex schools. The main feature of the plan is that the upper division students help their younger classmates, thus giving the faculty added study time. Both students and teachers benefit from this arrangement--the students by the added responsibility and the teachers by having time to update their knowledge and to pursue their specialties. Some biologists have felt that the undergraduates need more supervision than this program provides, but College of Wooster has not found this to be so. Since the teacher is not involved in preparing and giving lectures, his time can be spent in preparing suitable materials in the new techniques of instruction. These materials can then be used by the teaching students. (HH)

The environment of the benighted small college (and granted, there are several hundred small colleges that are not benighted) can obviously be improved. The officials of the college usually are painfully aware that the library is inadequate, that instructional facilities must be improved and that, generally, support of various kinds for the efforts of the faculty is not sufficient to the need. But it is much easier to defer such things as expansion of the library, addition of needed new faculty, and implementation of a vigorous sabbatical program than it is to defer paying salaries to existing faculty and covering the costs of needed repair and maintenance of buildings.

What, then, is to be done? First of all, I would suggest that we must agree with the small colleges that teaching is their primary function. Any research activity must be viewed in the particular context of the small college, i.e., does the research contribute to increased effectiveness of the faculty member as teacher and the undergraduate as learner? The rate of publication and the quality of publication then become secondary to the effects of scholarly activity on the teaching function. One must conclude that broader geographical dispersion of research grants and training grants under present criteria is not likely to provide much assistance to the small college. Rather, what is needed is a major increase in funding for many of the support mechanisms already tested and shown to be valuable (principally by the Undergraduate Division of NSF), with such ad[illegible]
as may be required. Titles I [illegible]
Act, for example, are begin[illegible]
library and equipment pro[illegible]
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college library situation. Title VI equipment grants from the U.S. Office of Education in the order of $20,000 to $50,000 are extremely helpful, but this effort loses its full impact if it serves to replace the NSF Instructional Equipment Program. Other federal efforts can be cited, but all are characterized by seriously limited funding when compared with the needs.

To return to the teacher, I think we would agree that existing in-service training programs for college teachers of science are well conceived and well administered, but sorely underfunded. Mechanisms do exist for a limited number of college teachers to carry on needed studies at the universities, but funding for released time for personal scholarly development on the home campus is extremely hard to come by. In this area, a mechanism for rejuvenation of continuing locally-administered sabbatical programs would be most useful.

It seems clear that the problem of the out-of-date faculty member in the small college setting is only one aspect of the larger problem of inadequate financial and intellectual resources. External support in large volume is required if these institutions are to become as effective in reaching their self-defined goals as they should be. But this support must be flexibly administered and based on an informed view of the nature and purposes of the institutions.

Converting our small colleges to universities will not solve the problem. The colleges have an important function, which [illegible]
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nstruction which have the same sus- [illegible]
effect as research and training grants [illegible]
tion.

A PROGRAM TO STRENGTHEN UNDERGRADUATE BIOLOGICAL EDUCATION

by Donald L. Wise
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SYNOPSIS: Every student deserves well informed teachers. Unfortunately, many college biology teachers cannot keep pace with the changes in biology and its related fields. This model program describes a technique demanding continuing faculty education while requiring greater participation of students in the educative process. Being a comprehensive plan, the model also emphasizes intellectual and professional development of the biology major through a sequence of courses progressing toward completely independent work. Special consideration is given the non-major. Courses for both major and non-major stress learning through inquiry. Although the model is designed for small colleges, it may be adaptable to larger and more complex schools.*

The scheme I describe attempts to predict faculty needs, student attitudes and the state of educational technology for the next decade. In this period, we will undoubtedly see massive changes in higher education.

If a college takes seriously its desire to educate mature men and women, the faculty must create the necessary environment in classrooms and laboratories to fully involve

* Anyone wishing to explore possible employment of a similar plan by his department should write the Director of CUEBS, 1717 Massachusetts Ave., N.W., Suite 403, Washington, D.C. 20036.

each student in the thinking-learning process. This can occur only when the student is challenged to solve his own problems. Furthermore, the philosophy of the model assumes that the biology department environment will create a desire in the upperclass student to help guide his younger classmates. (Will he not be expected to assume this role when he leaves school?) It is easier to visualize this model in a small college than in a large one, although such relatively large institutions as San Francisco State College and Tufts University have also been using undergraduate teachers successfully (the ultimate in student academic responsibility). Their success indicates its potential in larger schools.

Students are clamoring for more voice in their education. This program gives it to them—with proper supervision. The need for the added faculty study time which results is so familiar as to require no reiteration here. Finally, the educational devices suggested here are already with us today. I predict that they will be as commonplace as blackboard erasers tomorrow.

Most biologists would agree that the most important ingredient in formal education is the teacher. The fact that students depend on the college biology teacher not only as an intellectual leader, but also as a prime source of information cannot be overstated. If the teacher falls behind in his conceptual grasp, command of the data and skill in using the tools of his discipline, all his students suffer. This responsibility weighs heavily on the professional conscience of biologists. Summer institutes and conferences have not proven adequate to the educational need for biology faculty, since they accommodate a very small number of individuals and offer a restricted set of subjects. The problem is of such magnitude that the solution calls for continuous commitment on the part of every college biology teacher throughout his professional life to the extent of devoting about one-third of his professional activity to study (other than that required for specific course preparation and research).

Faculty Specialization

It is now very apparent that the wealth of new information flooding in upon biologists makes continued education in the home institution necessary. Those teaching in institutions with graduate programs are given time for this through their graduate school activities and personal research. Universities have recognized the importance of their graduate faculty being highly competent leaders in particular areas of biology and thus have granted reduced teaching loads so that they may participate in biological research. However, many small undergraduate institutions, through a tradition of teaching exclusive of research and because of new enrollment pressures, do not allow their biology faculty to pursue their specialized interests. Also, many faculty members often lack sufficient knowledge of science areas related to biology commensurate with what they expect their biology majors to know.

Teachers in small colleges cannot devote a significant amount of time to study. At present, the common way to release teachers for re-education is to increase the size of the faculty, thereby reducing contact hours. However, because the funds available to hire additional staff are exceedingly limited and the number of biologists available is similarly critical, it seems that some new approach is needed.

One such approach is described in the model curriculum and teaching staff responsibility being proposed in this article. This model is based upon several modern criteria believed to be fundamental to good teaching. The first of these is that any teacher can be expected to be competent in only a narrow area of specialization. This means that he will be trained in depth in only one area, while perhaps being a limited authority in a second related field. As most teachers in small colleges know, teaching a number of different courses at one time makes it very difficult for any one course to be presented as deeply as it should. Therefore, this model is designed so that a teacher will teach only one course in any unit of the academic calendar.

Student Intellectual Maturity

The proposed model also reflects the opinion that the transferal of information through the typical lecture system is not as effective in information transmission as new learning devices such as audio-tutorial booths, programmed learning books, single concept films and the other techniques which are constantly forthcoming. Teaching laboratories are not conducted in the traditional descriptive, regulated manner, but rather as the inquiry, open-ended type in which the student is expected to seek answers for himself to functional questions concerning biological material. Further, senior biology majors are utilized extensively as teaching faculty in this model. Experiments at The Pennsylvania State University indicate that undergraduates are successful teachers and, in many cases, are more effective than regular faculty (since they tend to work better with their peers). The use of undergraduate teachers serves many purposes. Most obviously, it frees the regular faculty for other pursuits, trains undergraduates to communicate what they have learned and serves as a stimulus to their learning. For those students preparing to become secondary teachers, it may replace the usual bio-methods course and may also encourage uncommitted students to enter college teaching. The overall academic objective of this model is to develop scientific maturity in biology majors both as investigative biologists and as communicative ones. This maturity is engendered by providing advanced courses of the independent-study type, subsequently making the biology major responsible for his own education.

In conversations with biologists, the most frequent reservation stated about this model is that most undergraduates need more direction than is given them in this program. Yet, how many of us have had experience in schools which have really tried to make students responsible for their own education? Colleges that have made a concerted effort to do this (the College of Wooster is among these) find that it is quite practical and that their graduates are more successful in the years immediately following graduation, whether as graduate students, businessmen or teachers.

In preparing th[illegible] model, it was assumed that professors enter college teaching highly motivated and properly educated, but that the environment of certain colleges destroys their incentive. Gustad (1960)[1] found that most college teachers he surveyed drifted into teaching because they wanted intellectually challenging positions which allowed them freedom to pursue their own interests. Those schools which inflict intellectual isolation and excessive teaching demands on their faculty accelerate teacher obsolescence. The model being proposed here appeals to both intellectual involvement and choice of academic pursuit for the individual biologist.

The normal load of the biology faculty member is designed so that he has 15 hours a week to be devoted to his own edu[illegible]tion, exclusive of all other commitments such as classroom preparation, grading and student contact. Furthermore, in this model, student contact should be more relevant to the needs of the students because it is personal and direct. Since the professor is not involved in giving lectures, the time for lecture preparation is devoted to preparing suitable materials in the new techniques of communication available to him.

This model is based on a college which has an enrollment of 300 students in the non-major biology course and a staff of six (models for schools with enrollments in the introductory or non-major course of 100 to 600 are suggested in Table 7). The assumption is made that biology for the non-major should be treated separately from that of the major. This places greater teaching responsibility on the faculty, but the model was developed with a maximum of teaching needs in mind. The number of students in the introductory sequence of courses for majors is based on 20% of the enrollment in the non-major course—15% biology majors and 5% others—probably majors in other sciences. Upper-level course enrollment is based on the number of biology majors alone. The curriculum consists of a biology major requirement of eight four-hour courses in an institution which has a two-semester academic year. The general grouping of the four courses includes a four-semester core or introductory sequence, two semesters of [illegible]vanced co[illegible] from a choice of four courses, and two senior-level courses, one in research and one [illegible] teaching.

As calculated, the student-faculty ratio in this model is approximately 20, which is higher than most small institutions. If a student-faculty ratio of 15:1 is desired, eight staff would be required; a ratio of 12:1 would mean a staff of 10.

Student-faculty ratios are typically determined by dividing the college enrollment by the number of full-time faculty. However, the student-faculty ratio in the biology department described above is determined by dividing the number of biology faculty into the total student enrollment in all the biology courses divided by 4 (since each student usually takes the equivalent of four 4-hour courses each semester).

Finally, the model is novel only in that it assimilates into one system many activities practiced separately in various colleges. In reviewing the model, one becomes aware that its usefulness may be far broader than enhancing faculty competence, since it has several other positive educational attributes. The latter may be so important that even if one disagrees with the time saved for continual education, its other aspects may justify its adoption.

1 Gustad, J. W. 1960. The career decision of college teachers. Southern Reg. Educ. Res. Monogr. Ser. No. 2.

MODEL BIOLOGY CURRICULUM AND STAFF ASSIGNMENTS TO PROMOTE SIGNIFICANT TIME FOR CONTINUED FACULTY EDUCATION

Table 1. WEEKLY PROFESSIONAL DUTIES OF EACH PROFESSOR

Activity	Av. Hours/Week
Continued education.	15
Average scheduled student contact.	6
Course preparation, grading, instructing teacher-students, advising research students, informal student contact and other academic duties.	24
	45

Table 2. BIOLOGY COURSES

101-2	8 hrs. every year. **Biology for Non-Majors.** 101 offered first semester; 102 offered second semester.
201-2-3-4	16 hrs. every year. **Introductory Biology for Majors.** 201 and 203 offered first semester; 202 and 204 offered second semester.
301-2-3-4	16 hrs. alternate years. **Advanced Biology.** One course given each semester in a four-semester (two-year) sequence.
401	4 hrs. every semester. **Individual Research,** for senior biology majors. (Every student needs this experience whether he has shown talent or not.)
402	4 hrs. every semester. **Teaching of Biology,** for senior biology majors.

Table 3. METHODOLOGY IN BIOLOGY COURSES

All courses divided into lab sections of 24-25, and each 100- and 200-level lab section divided into two discussion groups.

101-2, 201-2-3-4 — Taught using inquiry labs (4 hrs/wk) and two one-hour discussion meetings. Part of lab time will be audio-tutorial and will replace lectures; the rest will be inquiry *per se*. Groups will discuss selected readings, along with lab and A-T materials.

The professor meets with each discussion group once a week. A teacher-student meets with both discussion groups of a section and prepares its laboratory.

301-2-3-4 — These advanced courses are taught as independent study within assigned areas. The labs, if any, are advanced inquiry. The format for student evaluation may be examination, term paper, seminar or other device. The professor limits his contact hours to two hours per section. Since these are advanced students, they assume significant responsibility for preparing and maintaining the lab.

401 — Individual Research gives the student maximum responsibility for choosing his research area and presupposes he learned the fundamentals of research in 300-level courses. It culminates his intellectual development in undergraduate biology. Evaluation is difficult; perhaps a term paper is best. The professor has no scheduled meeting with his students and should interfere minimally with their work.

402 — Teaching of Biology. All senior majors will take some responsibility for teaching in the department. Two kinds of assignments will be recognized: (1) teacher-student in biology for non-majors and (2) teacher-student in 200-level major courses. Under the direction of the professor in the course, the teacher-students teaching the same 100- or 200-level course will be assigned one or two to a section. They will prepare the laboratory for their individual sections, guide discussion in the section's two discussion groups, administer and grade quizzes, give major exams and share the professor's responsibility for grading these. Preparation for each week's work will include two hours consultation with the professor regarding pedagogy, ultimate objectives of the course (as well as its weekly goals) and all other things necessary to prepare a good teacher. The teacher-student is expected to understand all the material in the course. His time each week will be distributed.

Conferring w/professor.	2 hours
Contact in discussion groups.	4
Contact in lab.	2
Lab and discussion preparation, grading, sharing in maintenance of the greenhouse, animal quarters and other tasks the faculty normally perform.	6
	14 hours

Students will be evaluated on a pass-fail basis.

This course can probably be designed to satisfy the biology teaching methods requirement for secondary school teaching certification.

Table 4. NORMAL MAJOR SCHEDULE FOR FOUR YEARS

	Biology	Chemistry	Physics	Mathematics
Freshman	201	General		Calculus
	202	General		Calculus
Sophomore	203	Organic	General *	
	204	Organic	(emphasizing	
Junior	301 or 303	Physical	electronics)	
	302 or 304			
Senior	401			
	402			

* Scheduling difficulties may postpone physics.

Table 5. ENROLLMENT AND NUMBER OF SECTIONS IN EACH COURSE FOR ONE SEMESTER

Course	Enrollment	No. of Sections	No. of Teacher-Students
101	300	12	12
201	60 [1]	3	3
203	60	3	3
301	45 [2]	2	0
401	23		0
402	22		0
			18

[1] Enrollment in 200-level courses based on 20% of enrollment in non-major course and includes 15% majors and 5% non-biology majors who probably major in another science.

[2] Enrollment in 300- and 400-level courses estimated at 15% of Biology 101. Only one-half of this 15% will be enrolled in 401 and 402 at one time (both are offered every semester).

Table 6. MODEL FACULTY TEACHING ASSIGNMENTS WITH 300 IN NON-MAJOR COURSE

Professor	Course	Sections	Contact Hrs.	401 Advisees	402 Advisees
A	101 [1]	3	6	4 [2]	4 [3]
B	101	3	6	4	4
C	101	3	6	4	4
D	101	3	6	4	3
E	201	4	8	4	4
F [4]	203	2	4	3	3
F	301	2	4		

[1] It is assumed that responsibility in 100-, 200- and 300-level courses will be redistributed each semester. Perhaps 200-level courses might be team taught.

[2] Some fair distribution of advisees among professors can be arranged.

[3] Economy in faculty time can be made in combining 402 students into one group to learn fundamental teaching methods.

[4] Only one professor prepares for more than one course.

Table 7. MODEL FACULTY NEEDS BASED ON VARIOUS ENROLLMENTS IN THE NON-MAJOR COURSE

Table 7a. COURSE ENROLLMENTS

101	No. Sections	201[1]	No. Sections	203	No. Sections	301[2]	No. Sections	402	401
100	4	20	1	20	1	15	1	7	8
150	6	30	2	30	2	22	1	11	11
200	8	40	2	40	2	30	2	15	15
250	10	50	2	50	2	37	2	18	19
300	12	60	3	60	3	44	2	22	22
350	14	70	3	70	3	52	3	26	26
400	16	80	4	80	4	60	3	30	30
500	20	100	4	100	4	75	3	37	38
600	24	120	5	120	5	90	4	45	45

[1] Enrollment in 200-level courses based on 20% of enrollment in non-major course and includes 15% majors and 5% non-biology majors who probably major in another science.

[2] Enrollment in 300- and 400-level courses estimated at 15% of Biology 101. Only one-half of this 15% will be enrolled in 401 and 402 at one time.

Table 7b. FACULTY TEACHING ASSIGNMENTS FOR 101 ENROLLMENTS OF 100 AND 600

101 Enrollment = 100 (Student-Faculty ratio 14:1)

Professor	Course	No. Sections	Contact Hours	401 Advisees	402 Advisees
A	101	3	6	2	4
B	101	2	4	3	2
C	203	1	2	3	2
C	301	1	2		

Note: If a student-faculty ratio of 20:1 is desired, teaching only 100 non-majors is uneconomical since at least three faculty are needed to give a minimum curriculum, resulting in a student-faculty ratio of 14:1.

101 Enrollment = 600 (Student-Faculty ratio 20:1)

Professor	Course	No. Sections	Contact Hours	401 Advisees	402 Advisees
A-C	101	4	8	3	4
D-G	101	3	6	3	3
H	201	3	6	3	4
I	201	2	4	4	3
J	203	3	6	4	3
K	203	2	4	4	3
L	301	2	4	4	3
M	301	2	4	4	3

CONVENTIONAL CURRICULUM

Comparison of the model to a conventional curriculum is difficult since one is unlikely to find a "typical" curriculum. For the sake of presenting a straw man, the conventional curriculum calls for a staff of six (the same size as the model). Each professor helps in the introductory course and teaches an advanced subject every semester. Often he gives a different advanced course each semester to "cover the field" of biology. The amount of preparation time is a very rough estimate, admittedly. I think it is realistic in terms of a good preparation. How many spend less time than I allowed, I do not know.

Table 8. A TYPICAL CONVENTIONAL CURRICULUM WITH EACH PROFESSOR TEACHING INTRODUCTORY BIOLOGY AND ONE ADVANCED BIOLOGY COURSE EVERY SEMESTER

Table 8a. COURSE ENROLLMENT BASED ON 300 NON-MAJORS

Course	Enrollment
Introductory Biology for Majors & Non-Majors (3 lectures, 1 3-hr. lab.)	360 (15 sections)
6 Advanced Courses (2 lectures, 2 3-hr. labs.)	27/course* (1 section/course)

Note: In order to attempt to personalize instruction in the introductory course, each professor lectures en masse to two or three sections of 24, but is with individual sections in the laboratory.

* Based on 15% of non-major enrollment in each of the sophomore, junior and senior courses.

Table 8b. WEEKLY PROFESSIONAL DUTIES OF EACH PROFESSOR

Professor A, B, C	
Continuing Education.	6 hours
Contact Hours.	17
Intro. Biology. 9 hrs. (3 lect., 2 3-hr. labs.)	
Adv. Biology. 8 hrs. (2 lect., 2 3-hr. labs.)	
Preparation time (including academic tasks like counseling and faculty committees).	22
Intro. Biology, 12 hrs.	
Adv. Biology, 10 hrs.	
	45 hours

Professor D, E, F	
Continuing Education.	1 hour
Contact Hours.	20
Intro. Biology. 12 hrs. (3 lect., 3 3-hr. labs.)	
Adv. Biology. 8 hrs. (2 lect., 2 3-hr. labs.)	
Preparation time.	24
Intro. Biology. 14 hrs.	
Adv. Biology. 10 hrs.	
	45 hours

DIFFERENCES

1. This model seemingly gives the major less choice of courses. It offers a selection of two from four 300-level courses, whereas the traditional curriculum often gives a six from twelve selection.
   a. Biology 201-4 is a four-semester introductory course for majors, allowing adequate time to cover the essential concepts in depth. Whether the topics covered must be taken in a specific sequence depends on each department's preference.
   b. The model permits the student (major and non-major) considerable freedom to explore his personal interests at the lower division level, which current systems do not.
   c. Student freedom in selecting a topic in 300-and 400-level courses gives greater choice of advanced topics than the traditional upper-level curricula.
2. The model does the following which are not part of the design of most contemporary curricula:
   a. The professor talks with students in groups of 12, not 24 or multiples of 24.
   b. It allows more time for preparation of teaching materials.
   c. As more effective teaching devices become available, they can be introduced with a minimum of course disruption.
   d. Students are forced to become involved in their own learning.
   e. Learning is more individualized.
   f. Creativity is promoted.
   g. The skills of teaching are taught to and practiced by every major.
   h. Since all faculty are involved in teacher training, their own teaching should improve.
   i. Non-majors are given a course designed for their needs.
   j. The model takes the major through a progression of experience designed to develop both knowledge and behavior essential to a biologist.
3. Many of the activities such as course preparation, sharing of teaching responsibilities in courses with large enrollments and the use of lab assistants are common to the model and present practices. The model seeks to redirect them toward more effective education.
   a. Course preparation time is essentially the same in both systems (20-24 hours), but time is usually devoted to one course in the model rather than divided between two courses as in the traditional system.
   b. Lab assistants are often used in introductory biology, but normally they work with no specific preparation for teaching and often assist only in the presence of the professor; therefore, they do not free faculty time.
4. The model takes advantage of effective time-saving methods for presenting material. However, it does not include current measures which appear to save time when, in fact, they do not.
   a. A standard practice to reduce contact hours is to give a mass lecture in the introductory course. This would free three contact hours for five professors, but would not significantly reduce their preparation time for the course unless they function in the lab with little knowledge of the course. If the latter occurs, they are better replaced by undergraduate lab assistants.
   b. Although the model does not depend on novel educational devices such as A-T booths, their use greatly strengthens its educational potential.

RECOMMENDATIONS FOR EFFICIENT USE OF TIME FOR FACULTY CONTINUING EDUCATION

1. In consultation with the chemistry, physics and mathematics departments, biologists should identify their weaknesses in these areas. Identified needs can be overcome in several ways:
   a. Attending undergraduate courses, including laboratory when desirable. Examinations, lab reports, and homework should be completed.
   b. If only a few isolated topics are required, special seminars and reading under the direction of an appropriate chemist, physicist or mathematician should suffice.
   c. Once competence has been re-established in chemistry, physics and mathematics, regularly scheduled (monthly) interdepartmental seminars would keep one up-to-date. This program could be supplemented by lectures from outside authorities.
2. Keeping abreast of biology requires attention to specific concepts, observations and techniques. Here each faculty member assumes responsibility for informing his colleagues about his special field. Weekly seminars might be one vehicle.
3. Special A-T materials, visiting lectureships, correspondence courses, film courses and TV tapes are all potential media for in-service education.
4. Good old-fashioned reading is still effective.

MOTIVATION OF FACULTY TOWARD CONTINUAL EDUCATION

The model motivates the student toward intellectual independence. Achievement of this independence gives satisfaction as well as stimulates further professional development. At the same time, the environment which originally enticed the professor to his profession is recreated for him. It seems untenable that any teacher in this system could not be moved by such an environment, especially if it is coupled with an engrossing program for continuing education. Any teacher whose spirit still remains untouched is probably untouchable.

ADVANTAGES OF REDUCING THE STUDENT-FACULTY RATIO

This model economizes by reducing the number of course selections. With larger staffs, more courses could be taught. More importantly, however, time would become available for creative scholarship which is not allowed in the model (nor in the traditional example). The new system probably will make the faculty desire personal participation in research. The curriculum culminates, in part, as research for the student. Why, then, should the faculty be denied what the undergraduate experiences? This is perhaps the weakest part of the model because it may create a discontented (although more competent) faculty. However, leading from this discontent will come faculty demand for research which will strengthen teaching further when teachers and students share their experience; it is difficult for one to advise another's research when he has no research activity of his own.

There will be a tendency to steal time for creative research from that assigned to continuing education. This should be avoided, since it leads back to obsolescence. Instead, other time has to be found for research. The undergraduate teacher must remain more of a generalist than the graduate professor because his teaching responsibilities demand it; thus, he is more sensitive to obsolescence. Being a competent generalist is as difficult and as rewarding as being a specialist. The specialist pursues his interest through research in a narrow field, falling behind in other areas. The generalist sacrifices his special interest for broader competency. Therefore, he cannot ignore broad in-service education in favor of specialized research.

Another creative activity which will be set in motion by the model is innovative teaching. The how and why of teaching will catch the scientific fancy of some biologists who, given sufficient time, will make significant contributions in this area.

GENERAL CONCLUSIONS

This model indicates that while improving his teaching the biology teacher's obsolescence can be averted. The curriculum has short and long term goals of student intellectual maturity. It offers great flexibility in content and method, and involves students more deeply in their education than do other schemes. Finally, the model requires no increase in staff size or special equipment.

ANNOUNCEMENTS

SPECIAL SESSION AT AIBS MEETING

A special session entitled **CUEBS: A Progress Report** will be held at the Annual Meeting of the American Institute of Biological Sciences, Ohio State University, September 4, 1968. In a series of brief talks, the professional staff will report on present activities and plans for the immediate future. Following these reports there will be time for questions and discussion with staff members in a small group format.

This session will be the first direct report to the biological community on the entire range of CUEBS' activities. Such reports are planned regularly for the future. The session is cosponsored by the Botanical Society of America and the National Association of Biology Teachers.

GRANTING FOUNDATIONS

Following is a list of foundations which grant monies primarily for curricular improvement, building construction, etc. in higher education. For further information, please contact the individual foundation.

The Dana (Charles A.) Foundation, Inc.; Smith Building; Greenwich, Connecticut 06830.

Resources for the Future, Inc.; 1755 Massachusetts Avenue, N.W.; Washington, D. C. 20036.

McCormick (Chauncey and Marion Deering) Foundation; 410 North Michigan Avenue; Chicago, Illinois 60611.

McCormick (Robert R.) Charitable Trust, 435 North Michigan Avenue; Chicago, Illinois 60611.

McGraw Foundation; 1200 St. Charles Road; Elgin, Illinois 60120.

Kellogg (W. K.) Foundation; 400 North Avenue; Battle Creek, Michigan 49016.

The Kresge Foundation; 211 West Fort Street; Detroit, Michigan 48226.

The Hamm Foundation, Inc.; 305 Wilder Building; St. Paul, Minnesota 55102.

Hill (Louis W. and Maud) Family Foundation; W-975 First National Bank Building; St. Paul, Minnesota 55101.

Fleischmann (Max C.) Foundation of Nevada; P. O. Box 1871; 195 South Sierra Street; Reno, Nevada 89505.

The Agricultural Development Council, Inc.; 630 Fifth Avenue; New York, New York 10020.

American Airlines Foundation; 633 Third Avenue; New York, New York 10017.

American Conservation Association, Inc.; 30 Rockefeller Plaza; New York, New York 10020.

Baker (The George F.) Trust; 20 Exchange Place; New York, New York 10005.

The Baruch (Belle W.) Foundation; 274 Madison Avenue; New York, New York 10016.

The Borden Company Foundation, Inc.; 350 Madison Avenue, New York, New York 10017.

The Burroughs Wellcome Fund; One Scarsdale Road; Tuckahoe, New York 10707.